UGA Wind-Turbine

WT 200 and WT 200/3

User Manual

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1.0 Safety precautions

All safety aspects concerning the WT 200 wind turbines are tabulated in the following table with focus on electronic, mechanical and installation pitfalls. Installers should read the manual prior to commence the project to put double attention on safeties.

Safety focus	Conditions
Rotor / Blades	During the testing of the system or field installation do not put your fingers or body to touch the rotor blades to avoid danger.
Generator	During the testing of the system or field installation, need to short circuit the power cable to strain the rotor/blades on high wind rotating
System grounding	Ground the system from the power control unit to avoid current leakage damage
Circuit breaker	Need circuit breaker to avoid system short circuit
Cable-specification	Follow VDE cable spec to select the suitable one

Tabelle 1 Table of safety focus

WT 200 Installation guidelines:

- Do not install the system on windy days
- Do not install the system on rainy days
- Install the system according to the IEC rules and local building regulations
- If you hear abnormal sounds or noice during the installation, call your qualified installer for trouble shootings
- Follow this user manual for installation
- Pay attention to safety concerns in all aspects

2.0 Specifications

General specifications of WT 200 turbines

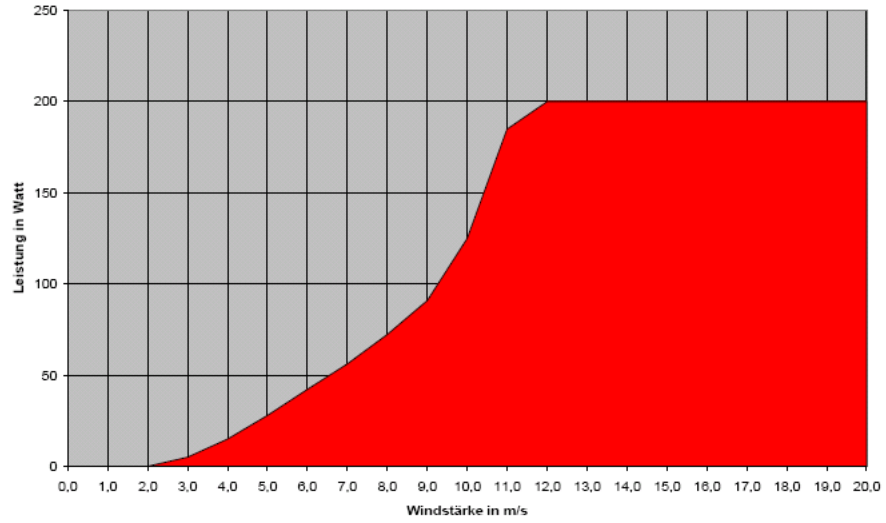
Article number	WT 200/1	WT 200/3
Shrouded design	Yes	Yes
Number of PM generators	1	3
Rated power (W)	200	600
Voltage output (Vdc)	12	12
Rotor diameter (m)	0.68	0.68
Number of blades/set	5	3x5
Start-up wind speed (m/s)	2.5	2,5
Rated wind speed (m/s)	12.0	12.0
Cut out wind speed (m/s)	20.0	20.0
Frame support	Simplex	Triplex
Dimension (mm)	912x330x1026	2052x330x2100
Weight (kg)	11	43
Yawing control	Passive	Passive
Brake	Electromagnetic	Electromagnetic

Table 2 General specification of WT 200 wind turbines

WT 200 power curve

The power curve of the WT 200 wind turbine has been outlined in the figure below.
When the wind speed exceeds 20 m/s the wind turbine will detect an over-voltage signal and automatically triggered the electromagnetic brake to suppress the rotor spinning speed.

Performance graph
Performance (kW)
Wind speed
Fig. 1 Power curve

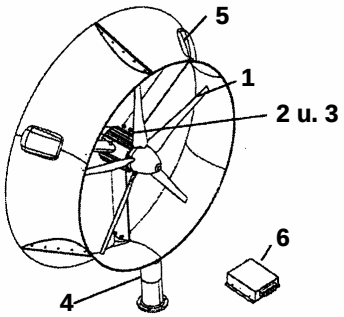


3.0 Configurations

The system configuration of the wind turbine WT 200 is consisting of (fig. 2):

1. Blade assembly
2. Generator
3. Nacelle
4. Yawing / Slip ring
5. Shroud assembly
6. Power control unit

Fig. 2



1. Blade assembly

The blade assembly is consisting of five blades on a wheel disc. Wind drives the blades to transform wind energy into mechanical torque, which in consequence, forces the rotor to rotate against the stator inside the generator. Since the blades are required to work in a hostile, high wind blowing, high rotating speed environment, therefore it is important to select suitable material to meet these requirements. We put head cone In this group to prevent pollution and corrosive material getting into the wheel.

2. Generator

The funtion of the generator is to convert rotor`s mechanical torque into electrical power. Inside the generator the key central rotor rotates against shell stator to unit. The WT 200 uses direct drive synchronous PM generator.

3. Nacelle

Inside the nacelle an IC circuit is designed to fit behind the generator, to rectify generator inducted AC current to DC current. It also detects overcurrent and sends a short circuit signal to trigger magnetic constrains to the generator.

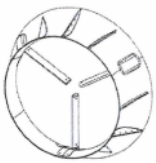
4. Yawing/Slip ring

The combined yawing/slip ring design ensures that the whole wind turbine unit will automatically face the wind to minimize the head-on wind blowing stress. The slip ring ensures the system to rotate 360° freely to transmit power without wiring the joint.

5. Shroud assembly

The shroud is composed of three Nylon shell covers, three oval-shaped, central-hollow aluminium bars, assembled in place by stainless steel bolts and lock washers. The function of the shroud is to collect wind and maximize the energy conversion efficiency (> 50%) by increasing the wind speed at the central rotor plane. The function of the oval-shaped aluminium bar is to streamline the passing air in a steady state (fig. 3)

Fig. 3 – Shroud-design



6. Power control unit

The function of the power control unit is to regulate the generated voltage (various from 0-25VDc) to a constant level to charge a battery bank. The manual brake design of the power control unit will restrain the turbine to work in a hostile environment. (fig. 4)

Fig. 4 – Power control unit

4.0 Field survey

The performance of the windturbine is strongly depending on the optimal location!

Step 1: Appraise wind prospect of a specified site

Check the wind atlas survey data (the wind energy distribution at 10m, at 30m and at 50m height) to find out the average wind speed near the chosen site. If the average wind speed at the spot exceeds 4m/s in our opinion the site is ok to install wind turbines. However the actual survey on wind velocity and wind blow direction has to be carried out before the installation.

Step 2: Measure the wind speed and direction at the specific site

The surveyor installs an anemometer at a specific site with requirements on height:

1. Open area - erect a 6m tower from the ground
2. Tall building - erect a 3m tower on the roof

On sampling rate:

1. Daily survey	1 sec./sample
2. Weekly survey	10 min./sample
3. Monthly survey	10 min./sample

Step 3: Survey topography of the site and determine the tower height

The general rule to find the right height is to detect the tallest object in the vicinity (the circular area of 170m diameter) of the tower. Add 10m to the height of this object to get the ideal tower height (fig. 5).

$H_t = H_0 + 10$ m

H_t = Ideal tower height
H_0 = Height of the tallest object within 170m vicinity of the tower.

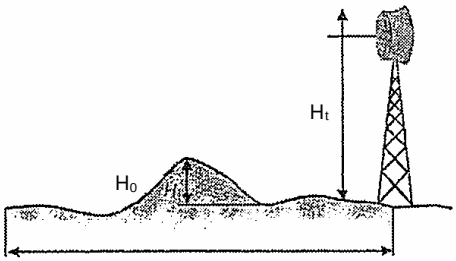


Fig. 5

Step 4: How to estimate the average wind velocity of a specific height (Table 3)

Please find out the average wind speed in a height of 10m or 30m in the wind energy distribution data wind of Wind Atlas. Then use the follwing formula to calculate the average wind speed at a certain height (V_t):

$V_t = V_{10} * (H_t/H_{10})^{*}(\log^{-1}\alpha)$

V_t : Wind speed at the tower height
V_{10} : Wind speed extract from Wind Atlas database at 10m level
H_t : Specific tower height
H_{10} : 10 m height
α : Wind shear effect

Table 3 –The factors of the wind shear effect.

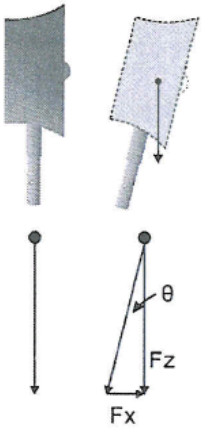
α	**Field description**
0.1	Calm lake surface
0.2	Short grass or low bush area
0.3	Distance with trees, hills or buildings
0.4	Neighbouring to trees or buidlings
0.5	Very close to trees or buildings
0.6	Surrounded by trees or buidlings

5.0 Installation

1. Verticality of the tower

There is an important relationship between the verticality of the tower and the mobility of the wind turbine yawing mechanism. The more inclined angle on verticality , the stronger wind blowing force to to overcome the deviated centroid weight (fig. 6).

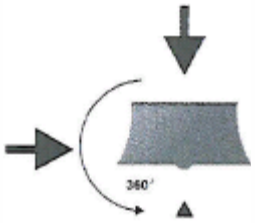
$F_x = F_z * \tan \theta$



θ : Verticality inclined angle
F_x : System centroid weight
F_z : Deviated centroid weight

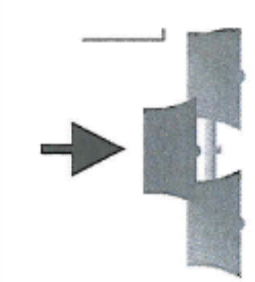
2. The effectiveness of wind blowing direction to system axis (fig. 7)

Single wind turbine:
The single wind turbine can rotate 360° to follow the wind blowing direction.



Triple wind turbine:
To get maximum energy conversion efficiency this system needs to be installed with its axis perpendicular to the major wind blowing direction.

Fig 7. The effectiveness of wind blowing direction to system axis



5.1 Installation single-turbine

Step 1: Follow the tower installation requirements to erect tower and pre-install cables inside the tower. Fix the bottom plate to the tower to the concrete foundation with specified bolts and nuts.

Step 2: Connect the cables from the wind turbine to the per-installed cables in the tower (colour match: Red for positive voltage, black for negative voltage)(fig. 8)

Step 3: Tread on wind turbine to the tower jointing set (fig. 9).

Step 4: Connect cables from the tower to the charger control unit. (Modell: CC-200-13)

Step 5: Connect cables from the charger control unit to the battery bank to complete the installation.

Fig. 8 – Connect cables from wind turbine to tower
Attention: Please fix the plug connections of the cables (the weight of the cabled is pulling them downwards)!

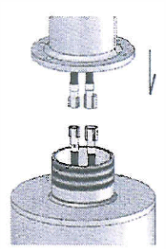


Fig. 9 – Connect wind turbine to tower

Fig. 10 – Connect cables from tower to charger control unit
Simplex tower; Charger control CC-200-12;

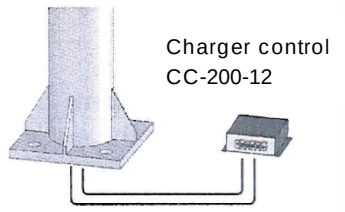
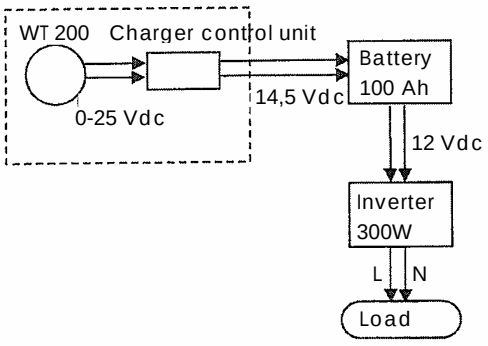


Fig. 11 – Cable routing of a simplex system

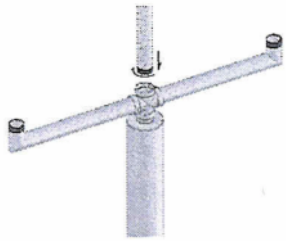


5.3 Installation triple-turbine

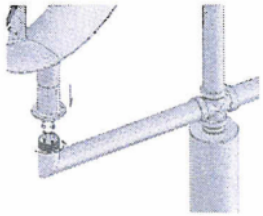
Step 1: Tread-on tri-tube to triple-tower and pre-install the cables inside the tower.

Step 2: Follow the tower installation requirements to erect tower and pre-install cables inside the tower. Fix the bottom plate to the tower to the concrete foundation with specified bolts and nuts.

Step 3: Connect cables from wind turbine to tower
Attention: Please fix the plug connections of the cables (the weight of the cabled is pulling them downwards)!



Step 4: Tread-on wind turbine unit to the tower jointing set. Fix the rotor blades that no electricity is generated during the installation! (fig. 13)



Step 5: Connect cables from tower to charger control unit (Modell: CC-200-12) (fig. 14)

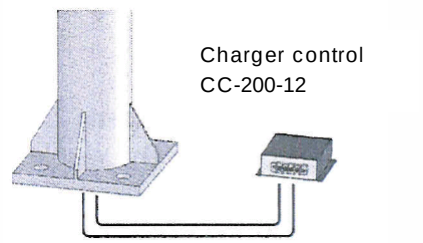
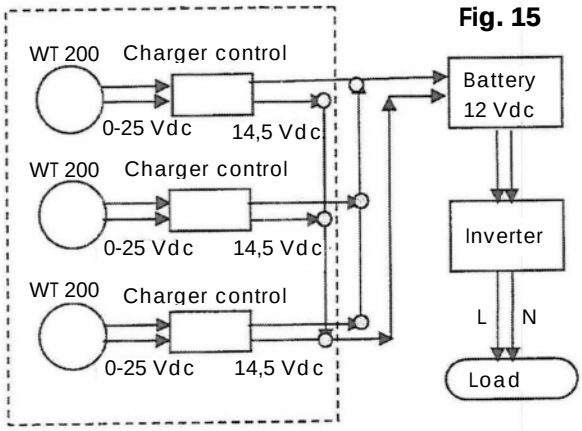


Fig. 15



Step 6: Connect cables from charger control to battery bank to complete the installation

Fig. 12 – Tread-on tri-tube to the triple tower
Fig. 13 – Connect cables from wind turbine to tower
Fig. 14 – Connect cables from tower to charger control unit CC-200-12;
Fig. 15 – Cable routing of a triple system
Triple system: 3 x charger control; battery (not included in the delivery); inverter; user

6.0 Operation

Before system installation

Check item	Tool
Funtionality of a generators output cable	Digital multi-meter
Functionality of a charger control	12 Vdc power supply
Voltage level of battery	Digital multi-meter
Funtionality of a inverter	12 Vdc power supply
Power consumption of a load	12 Vdc power supply

Table 4 System check before installation

After system installation

System link without ATS	System turn-on procedures	Pass/fail criteria	If ok fill in: ok
Wind turbine > power control unit > battery > inverter > load	Step 1: Check all cable connections	Make sure that all cable connections are correct on electrical polarity	ok
	Step 2: Check charge control	Make sure charge control regulates voltage at Vcc = 14,5 +/- 0,5 Vdc	ok
	Step 3: Check battery charging conditions	Make sure that battery voltage is higher than 10 Vdc: Vb > 10 Vdc	ok
	Step 4: Turn on inverter to commence operation	Make sure Wi>1.5*Wi (the power of an inverter is always 1,5 times higher than the power of load)	ok

System link with ATS	System turn-on procedures	Pass/fail criteria	If ok fill in: ok
Wind turbine > power control unit > battery > inverter > **ATS** > load	Step 1: Check all cable connections	Make sure that all cable connections are correct on electrical polarity	ok
	Step 2: Check charge control	Make sure charge control regulates voltage at Vcc = 14,5 +/- 0,5 Vdc	ok
	Step 3: Check battery charging conditions	Make sure that battery voltage is higher than 10 Vdc: Vb > 10 Vdc	ok
	Step 4: Turn on inverter to commence operation	Make sure Wi>1.5*Wi (the power of an inverter is always 1,5 times higher than the power of load)	ok
	Step 5: Check if the system will automatically switch to power grid when battery ampere hours run low	Make sure if Vb < Vdc, the ATS will switch to city power	ok

Table 5 System check after installation

7.0 Maintenance

WT 200 maintenance schedule (table 6)

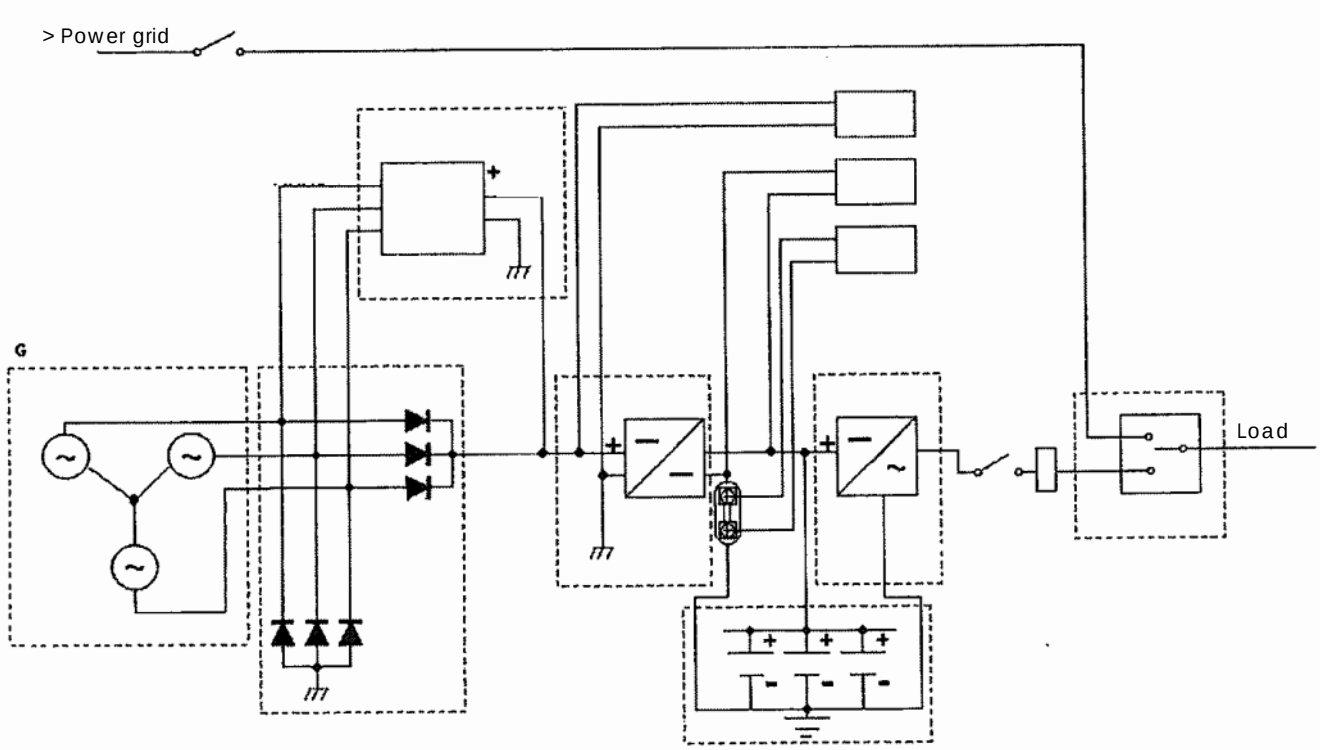
Field	Key parts	Maintenance schedule	Areas of focus
Mechanics	Rotor bearing	Semi-anual	Check bearing conditions on corrosion or any possible disortion
	Rotor shaft	Annual	Corrosion inspection
	Bolts	Annual	Tightness and corrosion inspection
	Blades	Annual	Fatigue, surface damage and disortion inspections
	Shroud	Annual	UV aging, surface damage and disortion inspections
Electronics	Slip ring	Semi-annual	Resistivity inspection
	Brake	Annual	Brake inspection
	Charger control	Annual	Charging inspection

8.0 Appendices

Appendix 1	Electric circuit layout
Appendix 2	Tower jointer
Appendix 3	Tower single system WT 200/1
Appendix 4	Tower triple system WT 200/3
Appendix 5	Single system (without tower)
Appendix 6	Triple system (without tower)

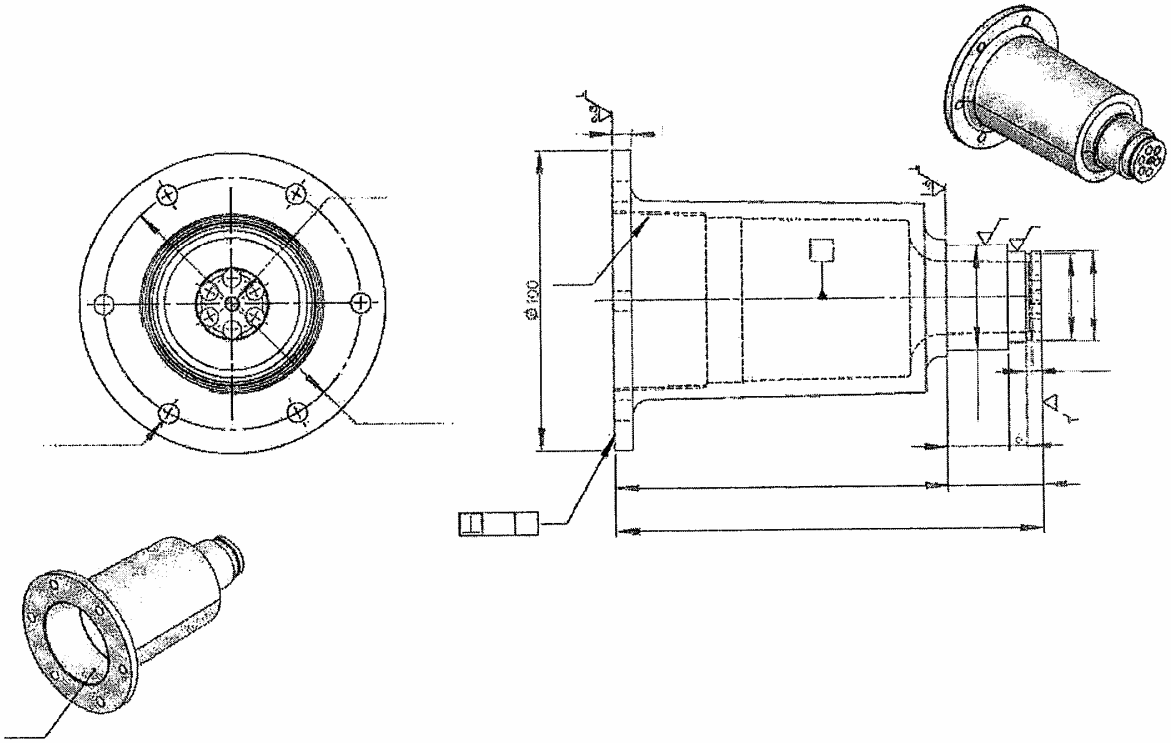
Appendix 1 –Electric circuit layout

From power grid… … … … … … … .. to load



Appendix 2 - Tower jointer

Raw drawing

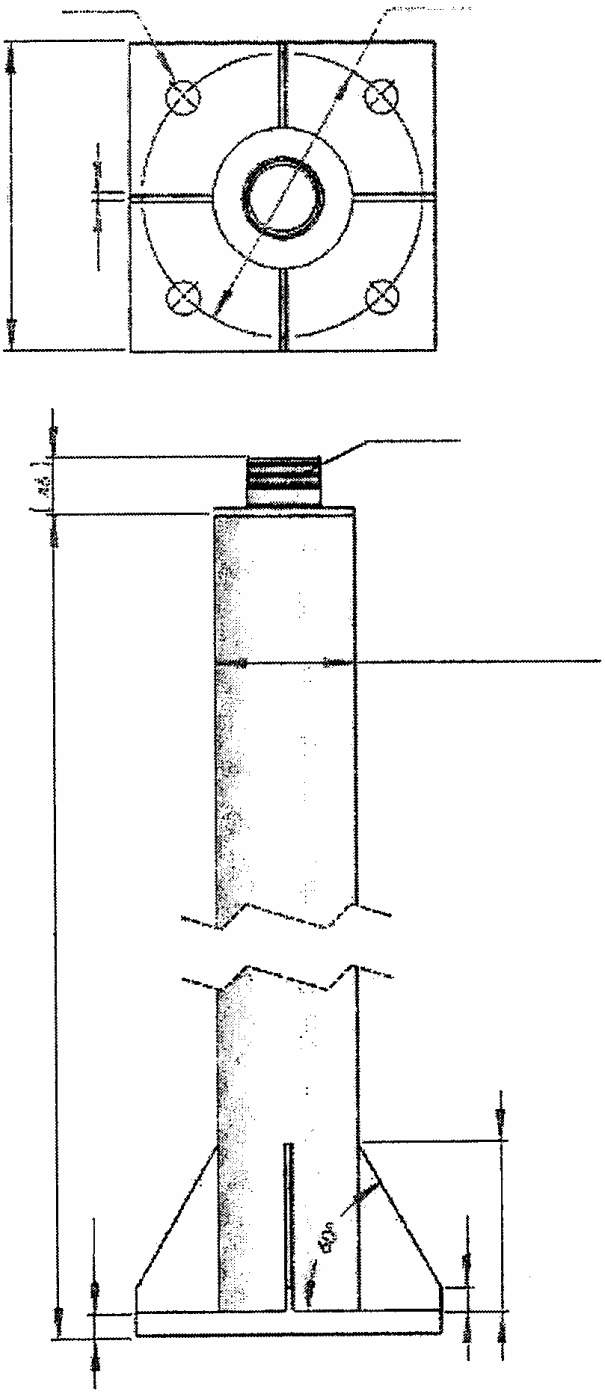


Appendix 3 - Tower single system WT 200/1 (Example)

Raw drawing, weight e.g. 85 kg,

Please use bolts according to the calculated requirements (producer of the tower)

Delivery by the installation company!

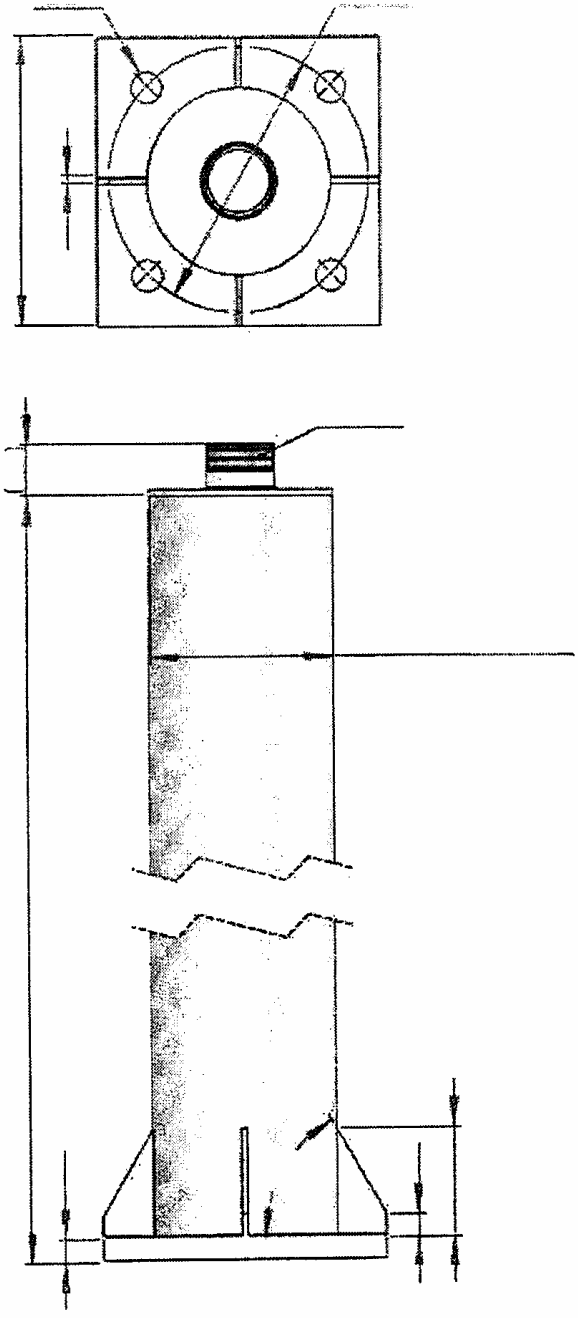


Appendix 4 - Tower triple system WT 200/3 (Example)

Raw drawing, weight e.g. 145 kg,

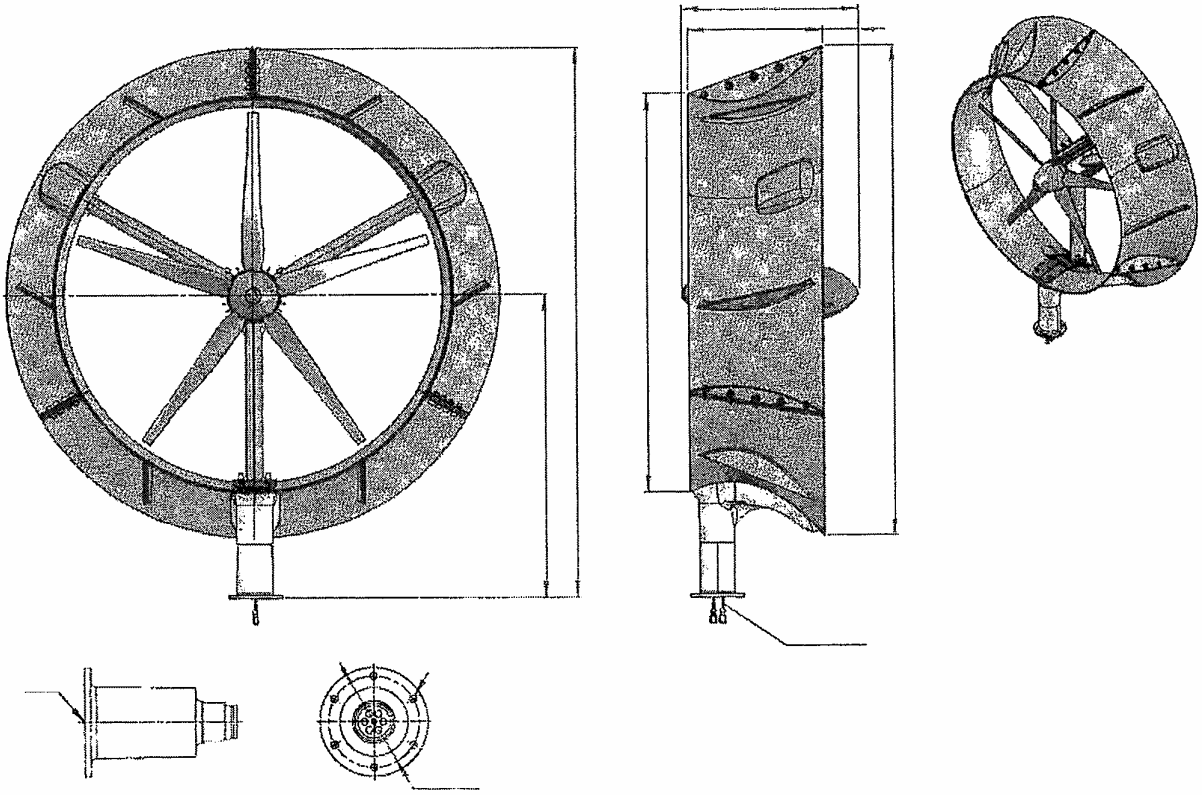
Please use bolts according to the calculated requirements (producer of the tower)

Delivery by the installation company!



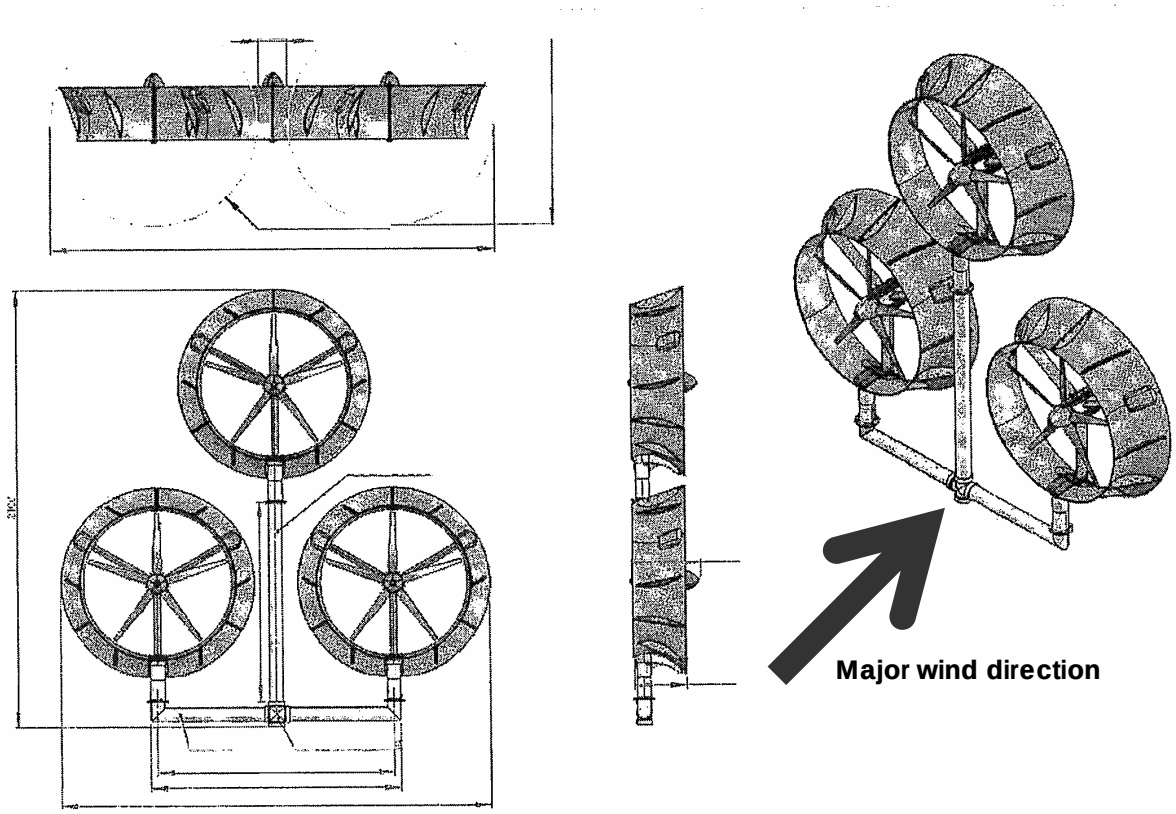
Appendix 5 –Single system (without tower)

Technical specifications 200 W wind turbine	
Rated power	200 W
Rated speed rotor	2.250 RPM
Rated wind speed	12 m/s
Starting wind speed	2,5 m/s
Cut out wind speed	20 m/s
Max. wind resistibility	60 m/s
Rotor no.	5
Rotor diameter	0,68 m
Voltage	12 V dc
Brake type	Electronic
Weight	11 kg



Please pay attention to the slewing range of the system!

Appendix 6 – Triple system (without tower)

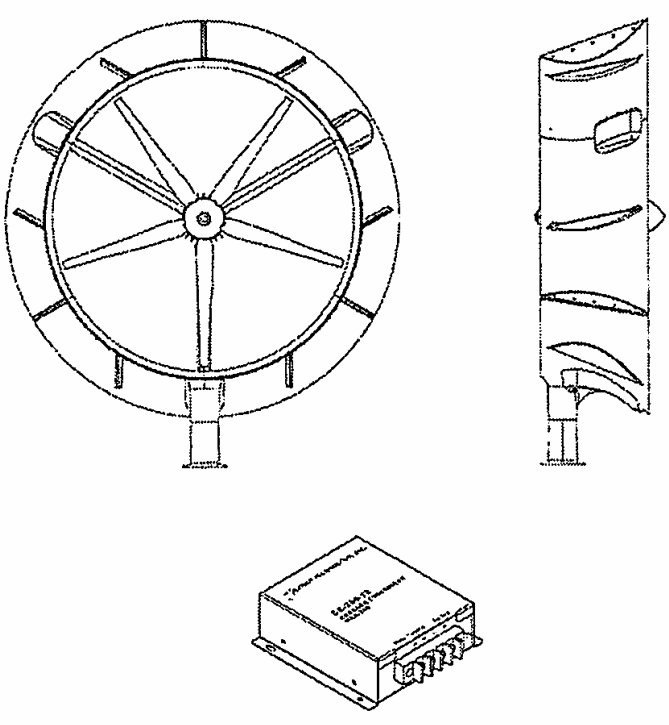


Please pay attention to the slewing range of the system!

Product specification

Model: WT 200
Product description: WT 200/1 Single system
Quantity: N/A
Oder no.: N/A
Customer name: N/A
Installation place: N/A
Installation date: N/A
Installation company/contractor: N/A

} To be completed by the installation company



WT 200/1 Single system

WT 200/1 Single wind turbine

Product	WT 200/1 Single wind turbine				Model	WT 200	Order no.	N/A
Rated power	200 W	Output Voltage	12 Vac	Dimension	912x330x1026		Weight	11kg
System assembly by installation company!								

No.	Key component	Assembly Code	Quantity	Major function
1	WT 200 shrouded wind turbine	WT 200/1	1	Use 1 set WT 200/1 to form a single model
2	Single frame support	ES 1	0	**Delivered by installation company**
3	Power control system	LS 200/1	1	1 charger controller

Your installation company gladly consults you regarding the utilization of the produced energy.
Examples:
You can produce warm water, built up your own power supply or feed power to the grid.